Stenting for Chronic Total Occlusion of the Proximal Subclavian Artery

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Summary

We report the results of 26 patients who underwent stent deployment for chronic total occlusion of proximal subclavian artery. From January 1998 to October 2005, 26 patients (18 male; mean age, 62.7 years, range 22 to 83 years), 28 lesions, underwent 29 procedures of stenting for chronic total occlusion of the proximal subclavian artery. Twenty-three patients had symptoms of claudication in their arm, no patients had subclavian steal syndrome. A brachial approach was used in 21 procedures, a femoral approach was used in five procedures, and combined femoral-brachial approach was required in three procedures. Primary stent deployment was success in 24 lesions (85.7%), and secondary procedure was success in one patient, totally 25 lesions (89.3%) were successfully treated by stenting. Procedure related complication occurred in four cases, including stent migration without symptoms in two procedures, hemianopsia on next day in a case, and TIA on unclear reason in one case. Permanent morbidity rate is 3.4% in procedure. Target lesion re-treatment required in three lesions, caused by subacute thrombosis, in-stent-restenosis, and dissection of the vessel by stent edge. The cases of subacute thrombosis and in-stent-restenosis were treated by re-PTA, and the case of dissection was treated by additional stenting. Secondary patency was 100%.

We conclude that stenting for chronic total occlusion of subclavian arteries appears feasible and safe.

Introduction

Chronic total occlusion of proximal subclavian artery is often asymptomatic, but sometimes lead arm claudication and/or fatigue. Subclavian steal syndrome and coronary-subclavian steal following internal mammary coronary artery bypass is rare[1]. If it is need to resolve these problem, surgical procedure, axillloaxillary bypass graft, common carotid-subclavian bypass graft, and aortic-subclavian bypass graft, has been effective, however, morbidity and mortality is high[2,3]. In the 1980s, percutaneous transluminal balloon angioplasty (PTA) was started as an alternative treatment for these lesions, but patency is limited by restenosis and reocclusion[4,5]. In 1990s, several authors reported that primary stenting for occlusive subclavian artery has superior to angioplasty[6,7]. We reported the results of 26 patients who underwent stent deployment for chronic total occlusion of proximal subclavian artery.

Material and Methods

From January 1998 to October 2005, 26 patients (18 male; mean age, 62.7 years, range 22 to 83 years), 28 lesions (bilateral lesions in two

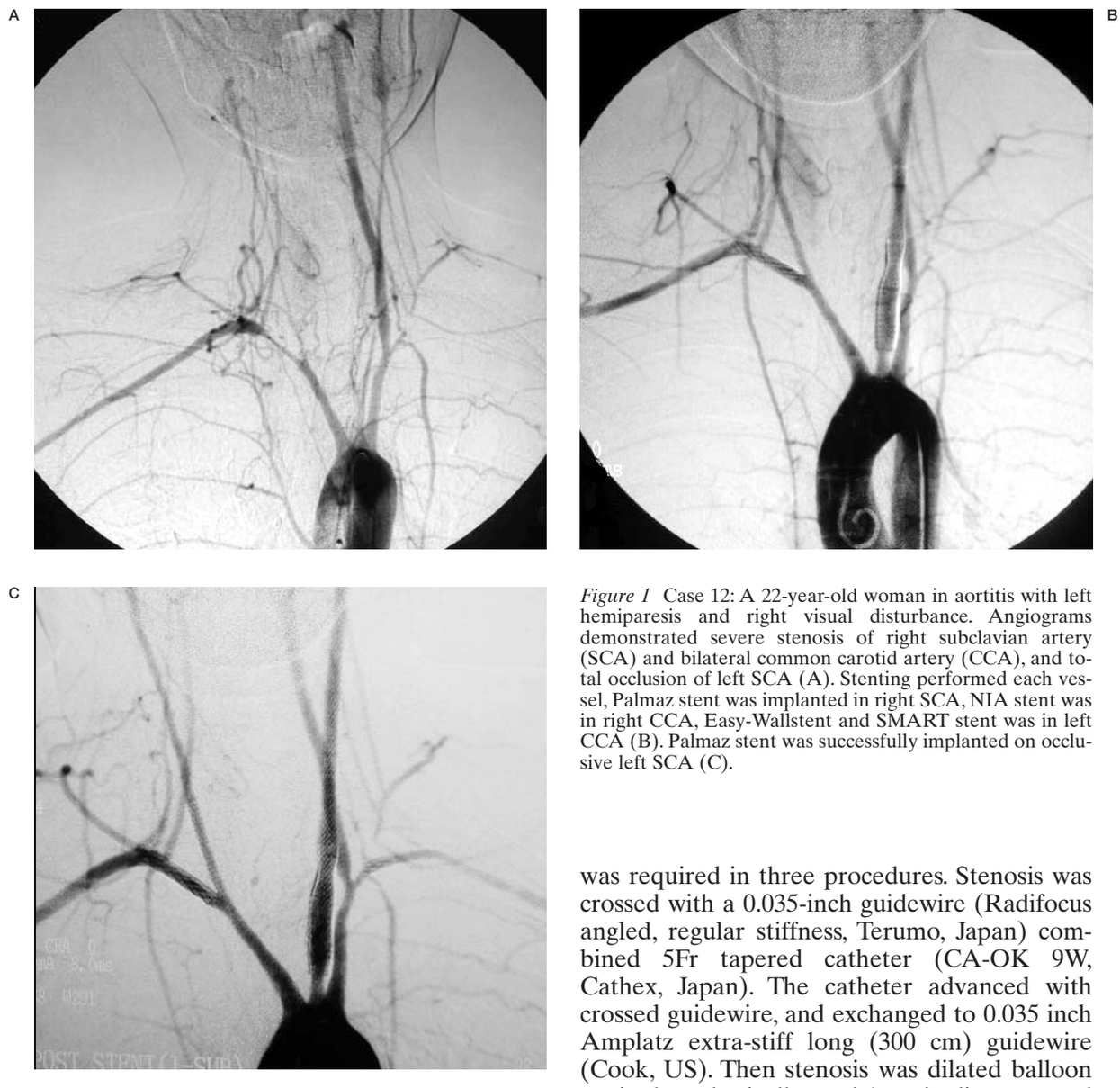

Figure 1 Case 12: A 22-year-old woman in aortitis with left hemiparesis and right visual disturbance. Angiograms demonstrated severe stenosis of right subclavian artery (SCA) and bilateral common carotid artery (CCA), and total occlusion of left SCA (A). Stenting performed each vessel, Palmaz stent was implanted in right SCA, NIA stent was in right CCA, Easy-Wallstent and SMART stent was in left CCA (B). Palmaz stent was successfully implanted on occlusive left SCA (C).

patients) were evaluated for chronic total occlusion of the proximal subclavian artery and Innominate artery. Twenty-three lesions had symptoms of claudication in their arm, and no patients had subclavian steal syndrome. Patients received 100 mg of aspirin and 100-200 mg of ticlopidine at least four days before procedure and 4,000-5,000 units of heparin infused at the start of procedure. In one patient, second procedure was needed six months after first procedure, brachial approach was used in 21 procedures, femoral approach was used in five procedures, and combined femoral-brachial approach was required in three procedures. Stenosis was crossed with a 0.035-inch guidewire (Radifocus angled, regular stiffness, Terumo, Japan) combined 5Fr tapered catheter (CA-OK 9W, Cathex, Japan). The catheter advanced with crossed guidewire, and exchanged to 0.035 inch Amplatz extra-stiff long (300 cm) guidewire (Cook, US). Then stenosis was dilated balloon angioplasty, basically used 4mm in diameter and 4cm in length (Powerflex, Cordis, US). Balloon expandable stent (Palmaz, Cordis, US) were used basically for totally occluded lesions in this series, except for a stent migrated case. Self-expanding stent (SMART, Cordis, US) was used for additional procedure via brachial approach in this case. If angiography showed optimal dilatation of occluded lesion after stent implantation, pull back guidewire and finish the procedure. No additional heparin infused and tapered naturally, anti-platelets continued for life. Six-months follow-up examination of angiography carried out in all cases, and prepared angioplasty in case of severe in-stent-restenosis.

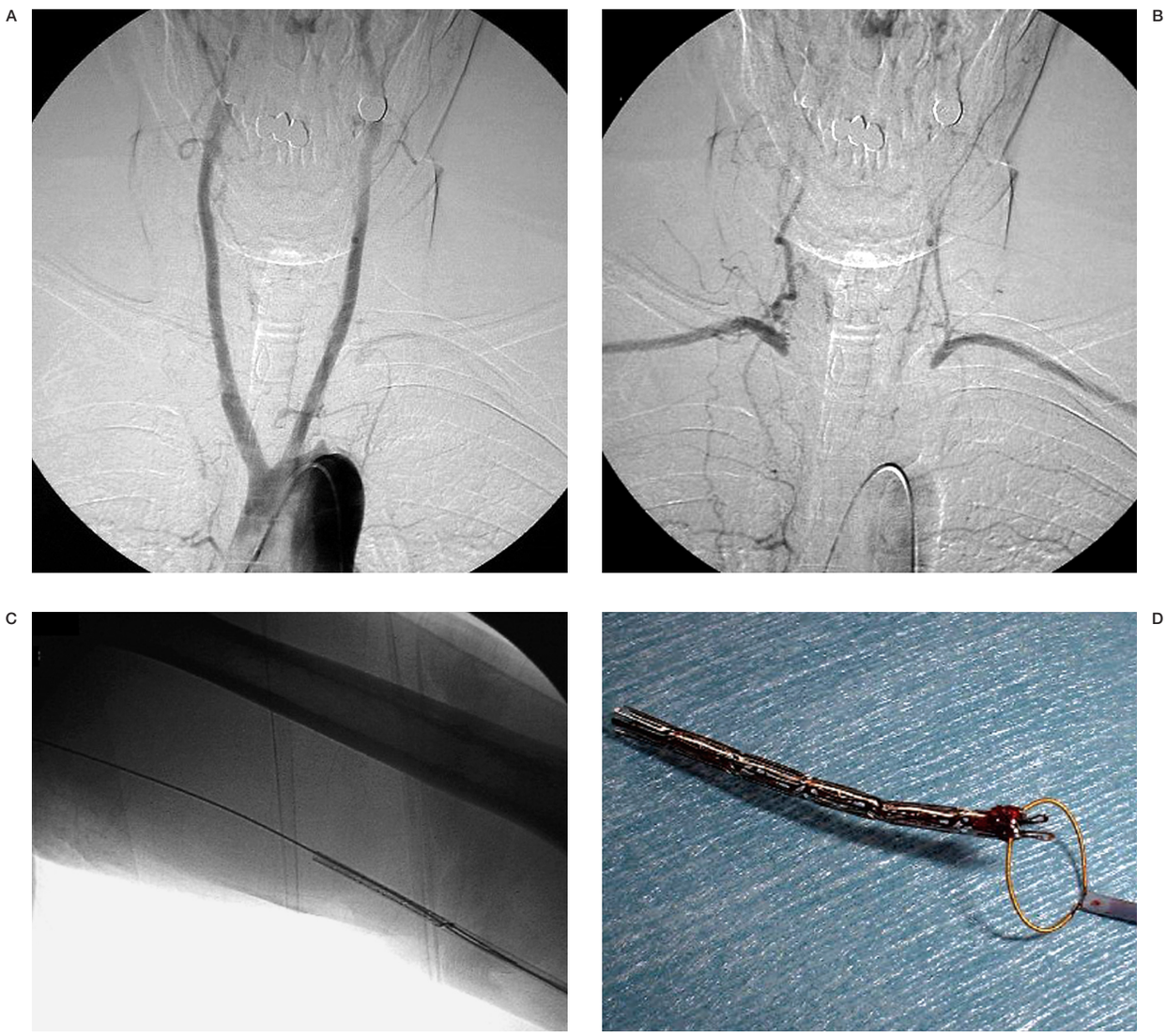

Figure 2 Case 6: A 52-year-old man with bilateral SCA occlusion (A). A Palmaz stent slipped off from the balloon catheter when it crossed the lesion (B). Stent penetrated guidewire, and Gooseneck Snare caught it. Then a SMART stent was positioned (C, D).

Results

Primary stent deployment was successful in 24 of 28 lesions (85.7%), and a secondary procedure, six months after first procedure, was successful in one patient, so a total of 25 of 28 lesions (89.3%) were successfully treated by stenting for chronic total occlusion of proximal subclavian artery.

In three out of 28 lesions, the guidewire could not cross the lesion and a endovascular approach was abandoned. Patients did not wish to be treated by a surgical procedure, and were sent to follow-up. Procedure related complications occurred in four cases, including stent migration without symptoms in two procedures, hemianopsia on the next day in one case, and TIA for an unclear reason in the remaining case. Permanent morbidity rate was 3.4% in procedure. Target lesion re-treatment was required in three lesions, caused by subacute thrombosis, in-stent-restenosis, and dissection of the vessel by stent edge.

The cases of subacute thrombosis and in-stent-restenosis were performed re-PTA successfully, and the case of dissection was treated

Table 1 **Case Summary of 29 procedures.**

No	age	sex	lesion	associate lesion	Sx, steal	Sx, arm	approach	stent	protection	complication	ISR	TLR	Memo
1	62	F	SCA-L	—	—	+	B	Palmaz	—	—	—	—	
2	67	F	SCA-L	—	—	+	B	Palmaz	—	stent migration	—	—	stent migration, additional stent used successfully, no deficit
3	63	M	SCA-L	—	—	+	B	failed	—	—			try
4	56	M	Innominate	—	—	+	B	Palmaz	—	—	—	—	
5	73	M	SCA-L	—	—	—	B	Palmaz	—	—	—	PTA	SAT(20days), successfully treated by POBA
6	52	F	Innominate	innmO,L-ICAS	—	+	F	Palmaz	—	—	—	Stenting	edge dissection and 2nd stenting at 20-months after primary procedure
7	52	M	SCA-L	bil-SCAO	—	+	B	(Palmaz),SMART	—	stent migration	—	—	stent migration and withdrawal, no deficit
8	=(Case 7)		SCA-R		—	+	B	Palmaz	—	—	—	—	contra-lateral lesion in case 7, 3 Palmaz stent used
9	62	F	SCA-L	—	—	+	B,F	failed	—	—			try
10	75	M	SCA-R	ICAS	—	—	B	Palmaz	—	—	—	—	
11	73	M	SCA-L	—	—	+	B	Palmaz	—	—	—	—	
12	22	F	SCA-L	R-SCAS,R-ICAO L-CCAS,L-SCAO	—	—	F	Palmaz	—	—	—	—	Aortitis
13	52	F	SCA-L	—	—	+	B	Palmaz	—	—	—	—	
14	59	M	SCA-L	—	—	+	B	Palmaz	—	—	—	—	
15	=(Case 9)						B	Palmaz	—	—	—	—	second procedure of case 9, 8 months after 1st procedure
16	75	M	SCA-L	—	—	—	B	Palmaz	—	—	—	—	
17	75	M	SCA-L	—	—	+	F	Palmaz	—	hemianopsia (day1)	—	—	PCA occlusion(embolism?)
18	64	M	SCA-L	—	—	+	F	Palmaz	—	—	—	—	
19	83	M	SCA-R	ICAS	—	+	B	Palmaz	—	—	—	—	
20	73	M	SCA-L	SCAO,V1S	—	+	B	Palmaz	—	TIA (day2)	—	—	reason is unclear
21	37	F	SCA-L	—	—	+	B	Palmaz	—	—	—	—	
22	69	M	SCA-L	SCAO,ICAS	—	+	B	Palmaz	—	—	—	—	
23	59	M	SCA-L	bil-SCAO	—	+	B	Palmaz	—	—	—	—	
24	=(Case 23)		SCA-R		—	—	B	Palmaz	—	—	—	—	contra-lateral lesion in case 23
25	61	F	SCA-L	—	—	+	F	Palmaz	—	—	—	—	
26	66	M	SCA-L	—	—	+	B,F	failed	—	—			try
27	75	M	SCA-R	bil-ICAS,bil-SCAO	—	—	B,F	failed	—	—			try
28	63	M	SCA-L	—	—	+	B	Palmaz	—	—	+	PTA	in-stent-restenosis(ISR)
29	62	M	SCA-L	—	—	—	B	Palmaz	—	—	—	—	
	62.7	M18 F 8	Innm-2 R-5 L-21	23.1% (6/26)	0	82.1% (23/28)	Brachyal 21 Femoral 5(+3)	%success=86.2% (25/29)	0	1=3.4% (1/29)	1=4.0% (1/25)	3=12% (3/25)	

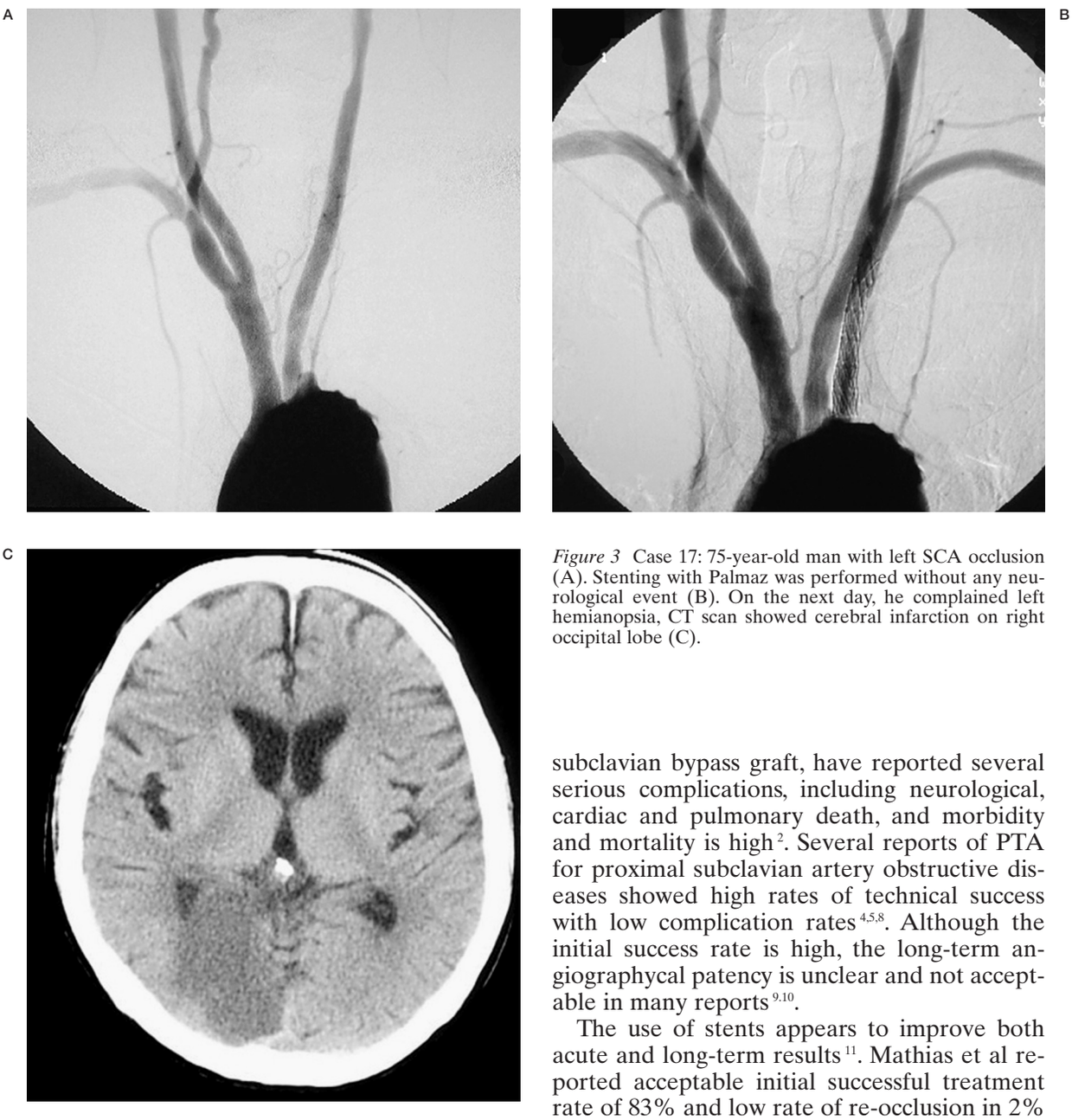

Figure 3 Case 17: 75-year-old man with left SCA occlusion (A). Stenting with Palmaz was performed without any neurological event (B). On the next day, he complained left hemianopsia, CT scan showed cerebral infarction on right occipital lobe (C).

by additional stent deployment. Secondary patency was 100% without any symptom during the follow-up period.

Discussion

Before catheter based intervention introduced to the treatment of occlusive disease of proximal subclavian artery, surgical procedures, axilllo-axillary bypass graft, common carotid-subclavian bypass graft, and aortic-subclavian bypass graft, have reported several serious complications, including neurological, cardiac and pulmonary death, and morbidity and mortality is high [2]. Several reports of PTA for proximal subclavian artery obstructive diseases showed high rates of technical success with low complication rates [4,5,8]. Although the initial success rate is high, the long-term angiographycal patency is unclear and not acceptable in many reports [9,10].

The use of stents appears to improve both acute and long-term results [11]. Mathias et al reported acceptable initial successful treatment rate of 83% and low rate of re-occlusion in 2% for subclavian artery occlusions with self-expanding stent. Our results are a little bit better than them that 89.3% successful rate of recanalization and no re-occlusion in the follow-up period, as balloon expandable stent used in this series. We had only one case of permanent morbidity with hemianopsia on the day after the procedure which may have been caused by embolism from the treated lesion. There were no embolic complications during the procedure. During revascularization of proximal subclavian artery, it is generally accepted that em-

bolic complications do not occur in the vertebro-basilar territory because reverse flow in the ipsilateral vertebral artery persists for some time after revascularization[12]. In general, occluded lesions had less favorable results with endovascular procedure, we concluded that primary stenting is recommended to chronic total occlusion of proximal subclavian artery, because high rate of initial and long-term success with no serious complication.

Conclusions

We successfully treated of chronic total occlusion of proximal subclavian artery with stent deployment in 89.3% of lesions. Three lesions needed re-treatment, but secondary patency is 100%. No procedure related complication occurred in our series. Stenting for chronic total occlusion of proximal subclavian artery gives excellent results.

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